648.41957CX1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appellants: TAMURA et al

Serial No.: 10/658,291

Filed: September 10, 2003

For: Vacuum Processing Device And Vacuum Processing Method

Group: 1763

Examiner: K. Moore

APPELLANTS' BRIEF

Mail Stop: Patent Appeals (Fee)
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

October 10, 2006

Sir:

This Appeal Brief is being filed under 37 CFR 41.37 in connection with the appeal of the above-identified application, a notice of appeal having been filed on August 7, 2006.

REAL PARTY IN INTEREST

The real party in interest is Hitachi High-Technologies Corporation of Japan.

RELATED APPEALS AND INTERFERENCES

No other appeals or interferences are known which will directly affect or

be directly affected by or have a bearing on the Board's decision in the pending appeal.

STATUS OF CLAIMS

Claims 1 - 4 and 8 have been canceled, leaving claims 5 - 7 and 9 pending in this application. All of the aforementioned claims, i.e., claims 5 - 7 and 9 stand finally rejected, and are on appeal. A copy of the claims, 5 - 7 and 9, which are on appeal, appear in the claims Appendix.

STATUS OF AMENDMENTS

An Amendment was submitted on July 3, 2006 in response to the final rejected dated April 4, 2006. An Advisory Action dated July 21, 2006 indicated that the amendments would be entered, and accordingly, the claims appearing in the claims Appendix hereto incorporate the amendments as submitted on July 3, 2006.

SUMMARY OF THE INVENTION

The present invention relates to a method for vacuum processing, and in particular, to a method for enabling transfer of wafers disposed in atmospheric air to a predetermined position within a vacuum processing chamber.

Independent claims 5 and 6 and dependent claims 7 and 9 relate to a plasma processing method for transferring a wafer from atmospheric air to a position within a vacuum processing chamber under a vacuum condition utilizing

atmospheric transfer equipment and vacuum transfer equipment. Looking to Fig. 1 of the drawings of this application, there is shown an atmospheric transfer unit 1 in atmospheric air comprising an atmospheric robot 7, cassette stages 6a, 6b and 6c, and wafers 60a, 60b and 60c stored in the cassette stages, as described in the second full paragraph at page 5 of the specification. One of the cassette stages, i.e., stage 6a, for example, can be utilized as an orientation alignment unit for centering or aligning the crystal orientation of the wafer taken out of cassette. A buffer or vacuum transfer chamber 2 under a vacuum condition is equipped with a vacuum robot 10 which is used to transfer the wafer into and out of a processing chamber, as represented by main processing chamber blocks 3a and 3b and subsidiary processing chamber blocks 4a and 4b by way of a load lock chamber 8 and an unload lock chamber 9 coupled between the atmospheric transfer unit 1 and the buffer or vacuum transfer chamber 2. Reference numbers 5a, 5b, 5c and 5d denote gate valves for connecting a subsidiary processing chamber block 4b, main processing chamber block 3b, main processing chamber block 3a and subsidiary processing chamber 4a to the buffer or vacuum transfer chamber 2, respectively, as described in the third full paragraph at page 5 of the specification. Within the main processing chamber blocks and subsidiary processing chamber blocks, there are provided main processing chambers 30a and 30b and subsidiary processing chambers 40a and 40b, respectively. Position sensors 11a, 11b, 11c and 11d are provided near the ingress path through which the wafer enters and exists a processing chamber for detecting the displacement of the transfer position of the wafer, as described in

the second full paragraph at page 6 of the specification. Vacuum gate valves are equipped to both the load lock chamber 8 and the unload lock chamber 9 between the buffer or vacuum transfer chamber 2, and atmospheric gate valves are equipped to both the load lock chamber 8 and the unload lock chamber 9 between the atmospheric transfer unit 1.

When the vacuum processing device is at a process preparation complete status (standby status), the buffer or vacuum transfer chamber 2, the main processing chamber and subsidiary processing chambers are each maintained at a vacuum pressure suited for each process such as etching or ashing, for example, as described in the fourth paragraph at page 7 of the specification.

In accordance with the method, as set forth in independent claims 5 and 6, a wafer such as a wafer 60a, which is an atmospheric air, is transferred to a position within a vacuum processing chamber, such as the vacuum processing chamber 3a through the vacuum transfer chamber 2 using the atmospheric robot 7 disposed in the atmospheric transfer unit 1 so as to enable performing a predetermined treatment, such as an etching treatment to the wafer in the vacuum processing chamber 3a, for example. As recited in independent claims 5 and 6, the method comprises "an atmospheric transfer step of transferring a wafer in atmospheric air to a vacuum transfer chamber using atmospheric transfer equipment disposed in atmospheric air". As described in the first full paragraph at page 7 of the specification, assuming that the cassette 6a is utilized as an orientation or centering unit, the atmospheric robot 7 extends, shrinks or moves its arm sideways so as to take out from the cassette 6b one of the wafers

stored within the cassette 6b and places the wafer on a stage within the centering unit 6a and retrieves the arm. At this time, the centering unit corrects the position of the wafer so that it is positioned correctly during subsequent procedures. Thereafter, the atmospheric robot 7 accesses the centering unit 6a again, takes out the wafer 60a having its position corrected, and positions the wafer on a stage in the load lock chamber 8 having the atmospheric gate valve thereof opened in advance. Next, the atmospheric gate valve is closed before the load lock chamber is evacuated and when the vacuum pressure is reduced to a pressure enabling the load lock chamber to be communicated with the vacuum transfer chamber 2, the gate valve between the load lock chamber 8 and the vacuum transfer chamber 2 is released. The vacuum robot 10 extends its arm to hold the wafer 60a placed inside the load lock chamber 8, and if the wafer is to be treated in the main processing chamber 30a, the gate valve 5c is released in the vacuum, and the wafer 60a is transferred into a wafer stage within the processing chamber 30a through the gate valve 5c. Thereafter, the vacuum robot 10 shrinks and retrieves the arm before the gate valve 5c is closed, and then the processing of the wafer is performed while the atmosphere within the processing chamber 30a is under a vacuum condition. Thus, as recited in independent claims 5 and 6, there is provided a vacuum transfer step of transferring step of transferring the wafer received from the atmospheric transfer equipment 1 to a position for the predetermined treatment within the vacuum processing chamber 30a using vacuum transfer equipment 10 disposed within the vacuum transfer chamber 2 which connects the atmospheric transfer

unit 1 and the vacuum processing chamber 30a, as described in the second full paragraph at page 7 of the specification.

As illustrated in Fig. 1, a position sensor 11 (11a, 11b, 11c, 11d) is arranged near the ingress path of a wafer to a respective processing chamber for detecting a position of the wafer being transferred. Fig. 2 of the drawings of this application shows a position sensor 11 having a view port 20 mounted on the upper wall of the buffer or vacuum transfer chamber 2 and an optical camera 12 which is equipped with an image recognition unit and which is capable of recognizing a position of the wafer being transferred, as described in the paragraph bridging pages 9 and 10 of the specification. Fig. 3 of the drawings is an explanatory view showing the position of the wafer being observed through the camera, wherein the correct position 601 of the wafer passing a reference line l_1 in the arrow direction is recorded in advance in the image recognition unit and the system recognizes the wafer position 602 of the actual wafer being transferred by the vacuum robot 10 passing the reference line l_1. Thereafter, by comparing these two positions, the image recognition unit can determine how far the wafer is displaced from the correct position 601 when it passed the line l_1, and therefore, by moving the arm of the vacuum robot 10 in the transverse direction with respect to the traveling direction by an amount corresponding to the detected displacement quantity $\Delta 1$, the transfer position of the wafer can be corrected during the movement of the wafer from the vacuum transfer unit into the processing chamber. As recited in independent claims 5 and 6, the method includes a step of detecting displacement of the wafer in a transverse direction

with respect to a traveling direction near ingress path of the wafer to the vacuum processing chamber by comparing a correct position of the wafer passing a line (the line l_1 as shown in Fig. 3, for example), which is predetermined in advance with an actual position of the wafer being transferred by the vacuum transfer equipment, as well as a step of moving a vacuum robot 10 of the vacuum transfer equipment which transfers the wafer in the transverse direction with respect to the traveling direction so as to correct the detected displacement of the wafer, as described in the first full paragraph at page 10 of the specification.

Figs. 4 and 5 of the drawings of this application illustrate a different embodiment of the wafer positioning detector 11, wherein Figs. 4 and 5 show the wafer position detector as utilizing optical sensors 13 which are disposed at plural points arranged in an arc along the outer rim of the wafer, which sensors are located at points A, B and C, respectively. As shown in Fig. 5, reference numeral 611 shows the correct position through which the wafer passes the reference line l2 in the arrow direction, and 612, 613 and 614 each show the actual position of the wafer being transferred along the arrow direction. When the actual wafer passes the reference line l_2 at a location displaced by $\Delta 1$ from the correct position, the sensor located at point A detects the wafer first and thereafter, the sensors located at points B and C detect the position of the outer rim of the wafer whereby, as described at pages 11 and 12 of the specification, the virtual positions of the wafer can be computed and the displacement amount $\Delta 1$ of the wafer can be computed. Thereafter, the arm of the vacuum robot 10 is moved in the transverse direction for a distance corresponding to the computed

displacement amount Δ1, thereby correcting the transfer position of the wafer to the proper position, as described in the paragraph bridging pages 12 and 13 of the specification. In this manner, as recited in dependent claim 7, the step of detecting the displacement of the wafer in the transverse direction with respect to the traveling direction near the ingress path of the wafer to the vacuum processing chamber comprises the step of detecting a rim position of the wafer being transferred in the vacuum transfer step using at least three optical sensors.

Thus, as explained above, and as recited in each of independent claims 5 and 6 of this application, initial positioning of the wafer is performed in atmospheric air within the atmospheric unit 1 by way of the centering unit 6a as described in the first full paragraph at page 7 of the specification, and thereafter, the displacement of the wafer in the transverse direction with respect to the traveling direction near the ingress path of the wafer to the vacuum processing chamber, such as chamber 30a, is detected directly by way of the detection unit 11, just prior to the predetermined treatment within the vacuum processing chamber, by control of the movement of the vacuum robot 10, as described in the specification of this application in the paragraph bridging pages 12 and 13 and the first full paragraph at page 13 of the specification.

As illustrated in Fig. 1 of the drawings and as recited in dependent claim 9, the displacement of the wafer in the transverse direction with respect to the direction near the ingress path of the wafer to the vacuum processing chamber is detected within the vacuum transfer chamber 2 at a position proximate to an inlet a respective vacuum processing chamber 30 or 40, as represented by a gate

valve 5 thereof, and which processing chamber effects a predetermined treatment of the wafer, as described in the first full paragraph at page 13 of the specification, noting that as described in the paragraph bridging pages 13 and 14 of the specification, the transfer accuracy performed by an operator based on visual observation is at best 3/10mm to 2/10mm, but the present invention enables improvement of the accuracy by about 10 times or to a level of approximately 2/100mm, whereby the displacement of the transfer position of the wafer is detected and corrected directly prior to the stage wherein predetermined processing is effected so that the wafer can be correctly transferred and positioned with high accuracy as described in the last paragraph at page 14 of the specification.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 5 - 7 and 9 are rejected under 35 USC 102(b) as being anticipated by US Patent No. 6,198,976 to Sundar et al.

ARGUMENTS

All claims stand rejected under 35 USC 102 based upon Sundar et al, and as to the requirements to support a rejection under 35 USC 102, reference is made to the decision of In re Robertson, 49 USPQ 2d 1949 (Fed. Cir. 1999), wherein the court pointed out that anticipation under 35 U.S.C. §102 requires that each and every element as set forth in the claim is found, either expressly or inherently described in a single prior art reference. As noted by the court, if the

prior art reference does not expressly set forth a particular element of the claim, that reference still may anticipate if the element is "inherent" in its disclosure. To establish inherency, the extrinsic evidence "must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill." Moreover, the court pointed out that inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.

Appellants note that the claims of the present invention on appeal recite a "method" which sets forth a particular manner of carrying out the method steps. Thus, in terms of a method, and in accordance with the decision of In re Robertson, supra, appellants submit that the specific method steps must be fully disclosed in Sundar et al, and insofar as the Examiner may contend that the method steps are inherent in Sundar et al, as noted in the aforementioned decision, inherency, may not be established by probabilities or possibilities, so that the mere fact that a certain thing may result from a given set of circumstances is not sufficient.

In accordance with the present invention, as illustrated in Fig. 1 and as described in the second full paragraph at page 6 of the specification, "Reference numbers 11a, 11b, 11c and 11d show position sensors for detecting the displacement of the transfer position of the wafers ... These position sensors are disposed near the ingress path through which the wafer enters and exits the processing chambers (for example, near the entrance of the processing

chambers)." (emphasis added). Furthermore, as described in connection with Fig. 3, in the first full paragraph at page 10 of the specification, "The correct position 601 of the wafer passing reference line l_1 in the arrow direction is recorded in advance in the image recognizing unit. Next, the system recognizes the wafer position 602 of the actual wafer being transferred by the vacuum robot passing the reference line l_1. Thereafter, by comparing these two positions, the image recognition unit can determine how far the wafer is displaced from the correct position 601 when it passed the line. Therefore, by moving the arm of the vacuum robot 10 in the transverse direction with respect to the traveling direction by an amount corresponding to the detected displacement quantity Δl, the transfer position of the wafer can be corrected. Further, since the distance of travel of the wafer from the reference line l_1 to the center stage of the processing chamber (distance of movement in the traveling direction) can be computed in advance, the movement within this distance can be controlled sufficient by fixed value control." (emphasis added). Appellants note that this detection of the displacement of the wafer in the manner set forth, which takes place during the vacuum transfer step in the vacuum transfer chamber by the vacuum robot 10, differs from an initial positioning, which includes a centering or aligning of the wafer, which is performed in atmospheric air utilizing the atmospheric robot 7 in connection with a centering unit 6a, which corrects the position of the wafer, so that it is positioned correctly within the processing chamber during subsequent procedures, as described in the first full paragraph at page 7 of the specification, for example.

As recited in each of independent claims 5 and 6, in which in the vacuum transfer step, the wafer is transferred within the vacuum transfer chamber to a position for predetermined treatment within the vacuum processing chamber, there is recited "a step of detecting displacement of said wafer in a transverse direction with respect to a traveling direction near an ingress path of said wafer to said vacuum processing chamber by comparing a correct position of said wafer passing a line which is predetermined in advance with an actual position of said wafer being transferred by said vacuum transfer equipment" (emphasis added), as well as the feature of "wherein initial positioning of said wafer is performed in atmospheric air" (emphasis added), and the feature that the displacement of said wafer in the transverse direction with respect to the traveling direction near the ingress path of said wafer to said vacuum processing chamber is detected directly just prior to the predetermined treatment within said vacuum processing chamber" (emphasis added). Thus, the independent claims 5 and 6 recite particular method steps carried out in a particular manner.

In applying Sunday et al under 35 USC 102, the Examiner contends that Sundar et al discloses;

> a step of detecting the displacement of said wafer (column 12, rows 63-65) in a transverse direction (the displacement can be detected while moving any direction) with respect to a traveling direction near an ingress path of said wafer to said vacuum processing chamber by comparing a correct position of said wafer passing a line which is predetermined in advance with an actual position of said wafer being transferred by said vacuum transfer equipment; (emphasis added)

and that:

initial positioning/alignment of said wafer is performed in atmosphere (column 11, rows 1-18) and the displacement (center-finding) of said wafer is detected directly just prior to the processing within said vacuum chamber (column 12, rows 63-65).

Irrespective of the position set forth by the Examiner, as noted in the "Abstract" of Sundar et al, this patent is directed to "A substrate center-finding method and apparatus, for determining the center of a substrate being passed through a substrate handling chamber ..." (emphasis added). The manner of determining the center of the substrate is generally described in the "Abstract" and further described in the specification of Sundar et al. Appellants submit that it is not seen that Sundar et al discloses in the sense of 35 USC 102 "detecting displacement of the wafer in a transverse direction with respect to a traveling direction near an ingress path of said wafer to the vacuum processing chamber by comparing a correct position of said wafer passing a line which is predetermined in advance with an actual position of said wafer being transferred by said vacuum transfer equipment" (emphasis added), as recited in each of independent claims 5 and 6 of this application.

Additionally, as described in column 6, lines 27 - 38 of Sundar et al, as referred to by the Examiner, the substrate handler 128, which operates in the mini-environment 120, serves for determining the location of the center of the substrate, while the substrate handler 128 moves the substrate through the mini-environment 120. As indicated by the Examiner, the mini-environment 120 represents an atmospheric environment not a vacuum condition. As described in column 12, lines 48 - 58 of Sundar et al, "In operation, ... the substrate handler

128 moves the substrates 156 from the pod 154 through the mini-environment 120 and into one of the load lock chambers 118 ... During each substrate movement, the substrate triggers the center-finding system, so the controller can calculate the center of the substrate and correct the position of the substrate before the substrate reaches the load lock chamber 118." (emphasis added). Thus, the center-finding system is rendered operational during the movement of the substrate from the pod 154 to the load lock chamber 118 in the mini-environment 120. Appellants submit, assuming arugendo, that Sundar detects displacement of a wafer, the displacement of the wafer is not detected "in a transverse direction with respect to a traveling direction near an ingress path of said wafer to said vacuum processing chamber by comparing a correct position of said wafer passing a line which is predetermined in advance with an actual position of said wafer being transferred by said vacuum transfer equipment", (emphasis added), as recited in independent claims 5 and 6.

Furthermore, while the Examiner refers to column 12, rows 63 - 65 of Sundar et al, which provides, "In an alternative embodiment, the center-finding procedure may be done in the transfer chamber 112, while the substrate is moved therethrough." (emphasis added). Appellants submit that the utilization of "alternative" is indicative of the fact that rather than the center-finding procedure being carried out in the mini-environment 120 by the substrate handler 128, the center-finding procedure may be, alternatively, carried out by the transfer chamber substrate handler 116 in the transfer chamber 112. However, the "alternative embodiment" also does not provide the method steps of independent

claims 5 and 6 of "a step of detecting the displacement of said wafer in a transverse direction with respect to a traveling direction near an ingress path of said wafer to said vacuum processing chamber by comparing a correct position of the wafer passing a line which predetermined in advance with an actual position of said wafer being transferred by said vacuum transfer equipment" (emphasis added), and/or the additional features of "wherein initial positioning of said wafer is performed in atmospheric air" (emphasis added), and the "displacement of said wafer in the transverse direction with respect to the traveling direction near the ingress path of said wafer to said vacuum processing chamber is detected directly just prior to the predetermined treatment within said vacuum processing chamber". (emphasis added).

Since column 12, lines 63- 65 of Sundar et al describes the alternative embodiment of the center-finding at any point during the movement of the wafer in the transfer chamber 112, it is readily apparent that the center-finding procedure is not effected in the mini-environment 120 of atmosphere, but rather in the vacuum transfer chamber 112, and not in addition to effecting the center-finding procedure in the mini-environment 120. Moreover, while the Examiner contends that Sundar et al discloses positioning detection at an point in the transfer chamber 112, appellants submit that Sundar et al does not provide a disclosure of detecting displacement in the transverse direction with respect to the traveling direction, near an ingress path to the vacuum processing chamber directly prior to the predetermined treatment being effected in the processing chamber as recited in the independent and dependent claims.

With respect to claims 7 and 9, whether or not it may be considered that Sundar et al discloses detecting a rim position of the wafer, it is apparent that Sundar et al does not compare a correct position of the wafer passing a line which is predetermined in advance, irrespective of the Examiner's comments, and that while the Examiner contends that the transfer chamber is proximate processing chamber, there is no disclosure in Sundar et al of displacement being detected at a position proximate to an inlet of the vacuum processing chamber which effects the predetermined treatment of the wafer. Again, appellants note that it is apparent that these features are not expressly described in Sundar et al, and insofar as the Examiner contends that such features are inherent, as noted in the decision of In re Robertson, supra, inherency may not be established by probabilities or possibilities, and that the mere fact that a certain thing may result from a given set of circumstances is not sufficient to support a rejection under 35 USC 102.

CONCLUSION

For the foregoing reasons, the Examiner's rejection should be reversed by this honorable Board.

A copy of the claims on appeal, i.e., claims 5 - 7 and 9 is found in the attached Claims Appendix and additional appendices are submitted, as required.

To the extent necessary, appellants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in the fees due in connection with the filing of this paper, including extension of time fees, to the deposit account of

Antonelli, Terry, Stout & Kraus, Deposit Account No. 01-2135 (Case: 648.41957CX1), and please credit any excess fees to said deposit account.

Respectfully submitted,

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CLAIMS APPENDIX

5. A vacuum processing method for transferring a wafer in atmospheric air to a position within a vacuum processing chamber through a vacuum transfer chamber using atmospheric transfer equipment disposed in an atmospheric transfer unit and performing a predetermined treatment to said wafer in said vacuum processing chamber; said method comprising:

an atmospheric transfer step of transferring said wafer in atmospheric air to said vacuum transfer chamber using said atmospheric transfer equipment disposed in atmospheric air;

a vacuum transfer step of transferring said wafer received from said atmospheric transfer equipment to a position for said predetermined treatment within said vacuum processing chamber using vacuum transfer equipment disposed within said vacuum transfer chamber connecting said atmospheric transfer unit and said vacuum processing chamber;

a step of detecting displacement of said wafer in a transverse direction with respect to a traveling direction near an ingress path of said wafer to said vacuum processing chamber by comparing a correct position of said wafer passing a line which is predetermined in advance with an actual position of said wafer being transferred by said vacuum transfer equipment; and

a step of moving a vacuum robot of said vacuum transfer equipment which transfers said wafer in the transverse direction with respect to the traveling direction so as to correct the detected displacement of said wafer;

wherein initial positioning of said wafer is performed in atmospheric air,

and the displacement of said wafer in the transverse direction with respect to the traveling direction near the ingress path of said wafer to said vacuum processing chamber is detected directly just prior to the predetermined treatment within said vacuum processing chamber.

6. A vacuum processing method comprising:

an atmospheric transfer step of transferring a wafer in atmospheric air to a vacuum transfer chamber using atmospheric transfer equipment disposed in atmospheric air;

a vacuum transfer step of transferring said wafer received from said atmospheric transfer equipment to a position for a predetermined treatment within a vacuum processing chamber using vacuum transfer equipment disposed within said vacuum transfer chamber connecting said atmospheric transfer equipment and said vacuum processing chamber;

a step of detecting the displacement of said wafer in a transverse direction with respect to a traveling direction near an ingress path of said wafer to said vacuum processing chamber by comparing a correct position of the wafer passing a line which is predetermined in advance with an actual position of said wafer being transferred by said vacuum transfer equipment; and

a step of correcting the displacement of said wafer by moving an arm of said vacuum transfer equipment in the transverse direction with respect to the traveling direction based on the result of detection performed by a wafer position sensor;

wherein initial positioning of said wafer is performed in atmospheric air, and the displacement of said wafer in the transverse direction with respect to the traveling direction near the ingress path of said wafer to said vacuum processing chamber is detected directly just prior to the predetermined treatment within said vacuum processing chamber.

7. A vacuum processing method according to claim 5 or claim 6, wherein

the step of detecting the displacement of said wafer in the transverse direction with respect to the traveling direction near the ingress path of said wafer to said vacuum processing chamber comprises a step of detecting a rim position of said wafer being transferred in the vacuum transfer step using at least three optical sensors.

9. A vacuum processing method according to claim 5 or claim 6, wherein

the displacement of said wafer in the transverse direction with respect to the traveling direction near the ingress path of said wafer to said vacuum processing chamber is detected within said vacuum transfer chamber at a position proximate to an inlet of said vacuum processing chamber which effects the predetermined treatment of said wafer.

EVIDENCE APPENDIX

None

RELATED PROCEEDINGS APPENDIX

None